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Understanding the morphology of Weak Impulsive Narrowband Quiet Sun Emissions (WINQSEs)

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The solar coronal heating problem has been around for several decades. While it has been well established that magnetic fields are responsible for transporting the energy from the photosphere to the corona, it has been a challenge to understand the details of the energy dissipation processes. One such process was proposed by Parker, who hypothesized that this dissipation occurs through small scale magnetic reconnections happening throughout the corona. While there are several indications that this mechanism may be active, till date direct observation of these small reconnections have not been possible. Hence searching for indirect signatures of these events is very important. One such probable signature was discovered by Mondal et al. (2020), where they demonstrated the presence of ubiquitous impulsive radio emissions in the solar corona during a very quiet time. These emissions are now named Weak Impulsive Narrowband Quiet Sun Emissions (WINQSEs). Due to the potential importance of this discovery and its implications, it is crucial that the detection techniques are improved and that we search for these transients in more datasets to confirm/reject their ubiquitous nature. In this work, we have developed a machine learning (ML) algorithm suitable for identifying and characterising the spatial distribution and morphology of WINQSEs. For morphological characterisation we use 2D Gaussians which are found to describe the brightness distribution of the majority of these transients very well. Since WINQSEs are expected to be the radio counterparts of the weak reconnections, we expected them to be essentially unresolved at an angular resolution of 3.5 arcminutes. We find, however, that most of the WINQSEs are resolved by the instrument, though the distribution of their area is very steep. We hypothesise that while intrinsically unresolved, the area of WINQSEs becomes large due to coronal scattering effects. This then also presents the exciting possibility of using WINQSEs to regularly study the nature of scattering close to the Sun, which currently is only possible during solar radio bursts. Here we present a quick overview of our ML algorithm, along with a summary of our results about the morphological properties of WINQSEs, and explore the possibility of using them to study coronal scattering.